

Negative Effects of Irrelevant Information on Learning Disappear Because People Learn to Ignore the Content, Not Just the Location

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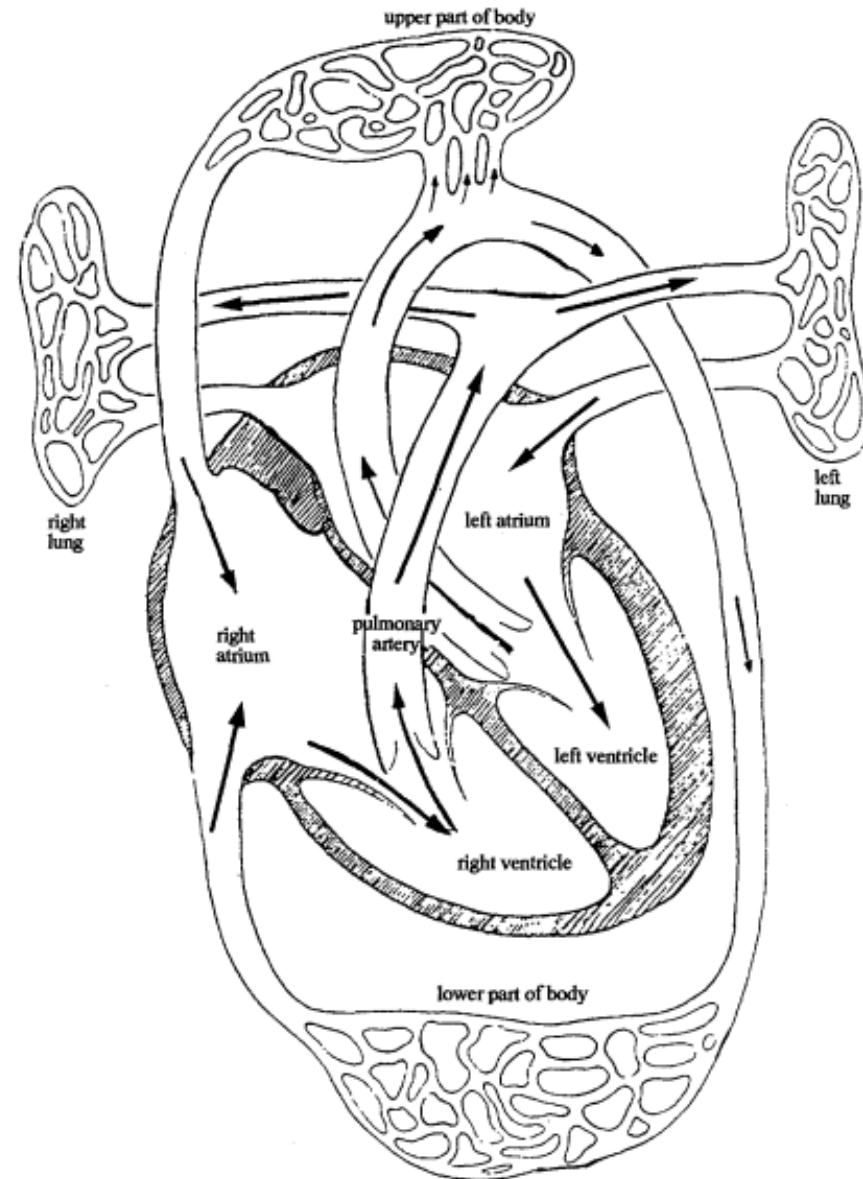
Effects of Irrelevant Information Presentation:

- Cognitive load theory: **Redundancy Effect**
- Presenting irrelevant or unnecessary information hampers learning (Kalyuga & Sweller, 2014).
- Overload of working memory

Diagram indicating flow of blood through the heart, lungs and body

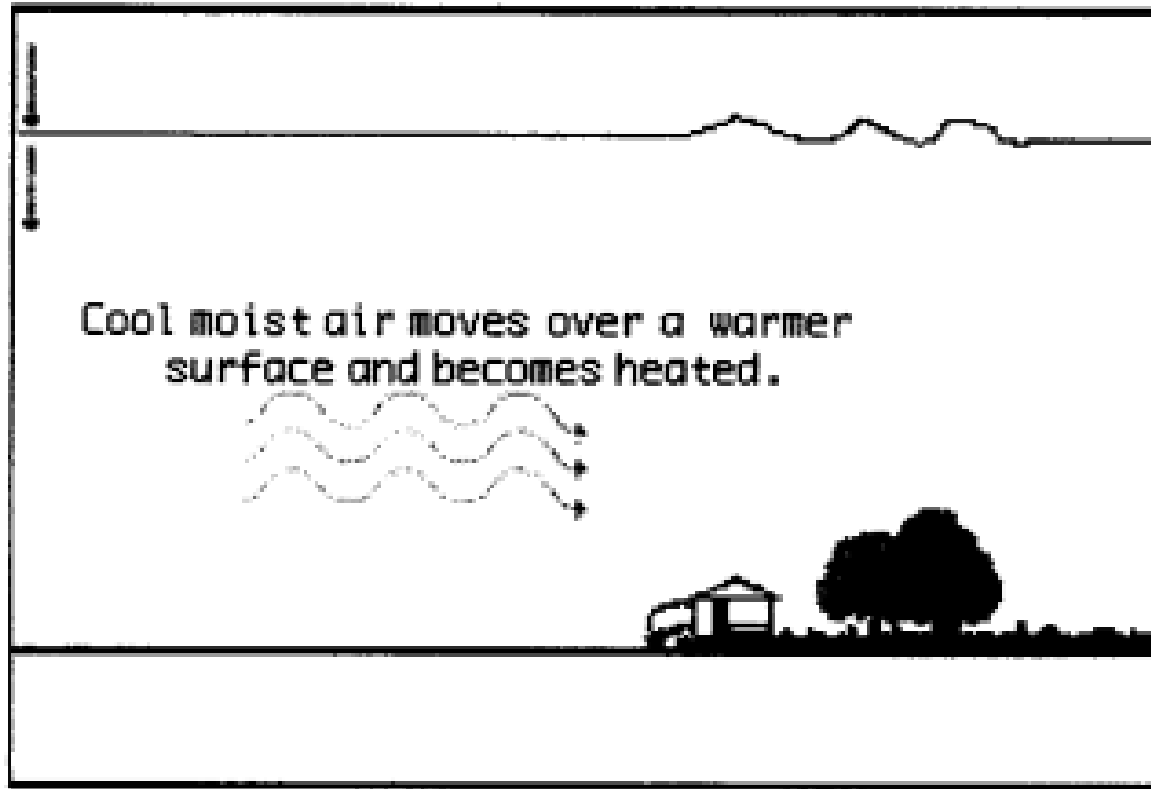
Example: Unnecessary Text

- Chandler & Sweller, 1991



1. Blood from the upper and lower parts of the body flows into the right atrium.
2. Blood from the lungs flows into the left atrium.
3. When the ventricles relax, blood from the right atrium flows into the right ventricle.
4. At the same time blood from the left atrium flows into the left ventricle.
5. When the ventricles contract blood is forced from the right ventricle into the pulmonary artery.
6. Blood is also forced from the left ventricle into the aorta.
7. The blood entering the pulmonary artery supplies the lungs.
8. The blood entering the aorta is pumped back to the body.

Example: Spoken + Written Text

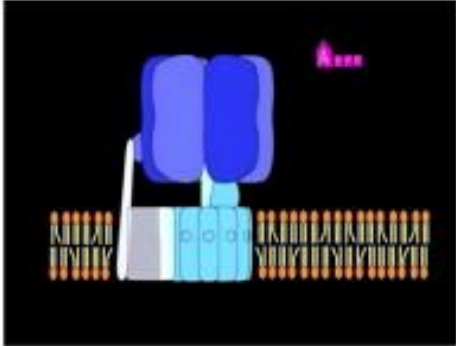


Moreno & Mayer, 1999

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Example: Coherence

ATP-Synthase2/11



The main energy supply of the cell- ATP (adenosine triphosphate). But how is it actually composed?


This protein is the key:

The so- called ATP-Synthase, a complex molecule.

It is located in the inner membrane of the mitochondria.

The use of ATP is the basis of all living processes.

Within every muscle movement, ATP is spent. In sports like running or ballsports, in hard physical jobs, or even while doing activities like typing, the body needs energy. This energy is provided in form of ATP.



Park, Moreno, Seufert, & Brünken (2011)

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Eye tracking research on attention to (ir)relevant info

Tenet: Irrelevant information hampers learning because learners cannot ignore it → extraneous processing. However:

- Experts fixate more on task relevant information than novices
 - Chess (Charness, Reingold, Pomplun, & Stampe, 2001)
 - Fish locomotion (Jarodzka, Scheiter, Gerjets, & Van Gog, 2010)
 - Electrical troubleshooting (Van Gog, Paas, & Van Merriënboer, 2005)
- With experience / training, learners start to ignore irrelevant information
 - Implicit learning task (Haider & Frensch, 1999)
 - Weather map inferences task (Canham & Hegarty; 2010; see also Hegarty, Canham, & Fabrikant, 2010)

A stylized, handwritten-style logo of the word "Erasmus" in a cursive font.

Would negative effects of irrelevant information on learning disappear with increasing task experience?

Prior study (Rop, Van Wermeskerken, De Nooijer, Verkoeijen, & Van Gog, under review).

Word learning task: Artificial language word coupled with action verb definitions. Word presented in writing, definition via audio. With second presentation of definition:

- No picture,
 - Meaningful picture, or
 - Irrelevant picture
-
- Three blocks of 5 words, with cued recall tests after each block.

First presentation / no pictures condition

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Meaningful pictures condition



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Irrelevant pictures condition



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Results prior study

- Irrelevant information *initially* hampered learning, but not after participants gained task experience (Exp 2)
- After the first block, participants adapted their study strategy: They *ignored* the irrelevant information (Exp. 3, with eye tracking)

Current Question:

The irrelevant information always appeared **at the same location** on the screen.

→ Did participants learn to ignore the *content*, or the *location* of the irrelevant information?

Present study

- Participants learned words with either irrelevant or meaningful pictures.
- For half of the participants, the picture location switched in the third block.
- So four conditions: Meaningful (M), meaningful switch (MS), irrelevant (I), and irrelevant switch (IS).



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Hypotheses

Attention can be controlled either top down or bottom up.

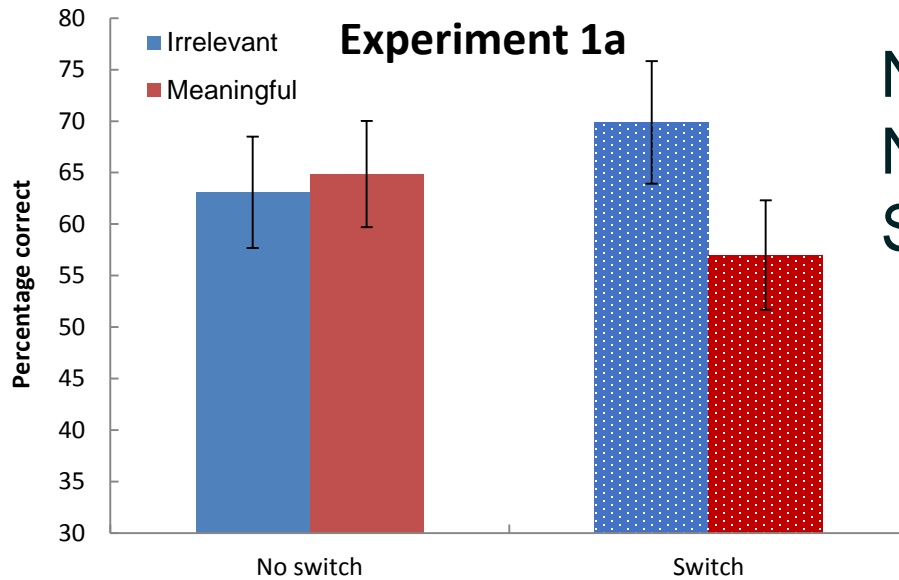
- H1: If top down influences are stronger, irrelevant pictures will not start to hamper learning again after a location switch.
- H2: If bottom up (saliency) influences are stronger, irrelevant pictures will start to hamper learning again after a location switch.

Method

- Two Experiments, to replicate our results
- Participants were recruited using Amazon's Mechanical Turk and were paid \$1.50 for their participation.
- Experiment 1a: 327 participants ($M_{\text{age}} = 37.50$),
- Experiment 1b: 352 participants ($M_{\text{age}} = 36.25$)

Randomly distributed over the M, MS, I, and IS conditions.

Results Block 3



No main effect of Switch



No main effect of Pictures



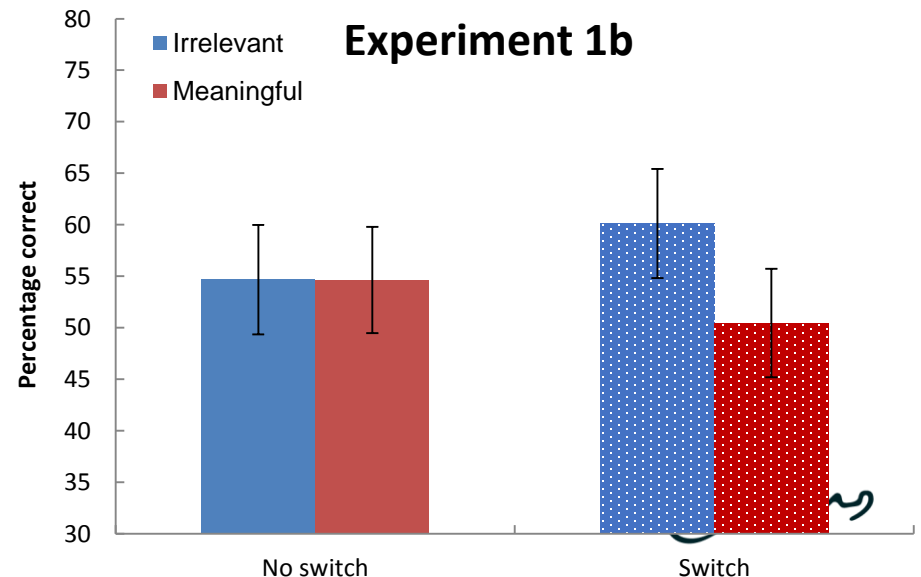
Significant interaction



No main effect of Switch
No main effect of Pictures
Trend towards interaction



Error bars represent 95% confidence intervals



Discussion

- Surprisingly, only in the MS condition word learning was hampered in block 3
 - Experiment 1b replicated this result.
- Content determines how pictures are processed: Participants learned to ignore irrelevant pictures, even after a location switch!
- Top down vs. Bottom up.
- Learners can overcome less optimal designed learning materials, even without explicit instruction to do so.

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Future directions / Implications

- Study whether these effects also occur with other types of irrelevant information presentation.
- Importance of studying cognitive load effects over time, with repeated task presentation.
- Importance of research on (adaptation of) study strategies and self-managed cognitive load (Agostinho, Tindall-Ford, & Roodenrys, 2013; Gordon, Tindall-Ford, Agostinho, & Paas, 2016; Roodenrys, Agostinho, Roodenrys, & Chandler, 2012).

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Thank you for your attention!



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